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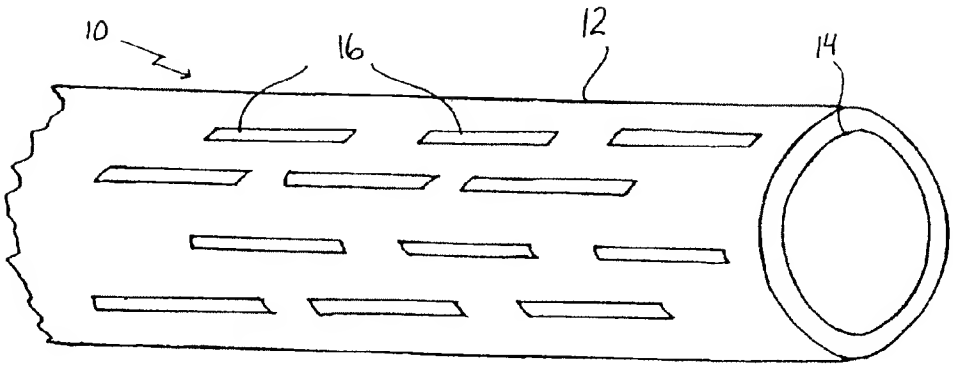
(54) **METHODE DE REDUCTION DE LA LARGEUR D'ORIFICES D'ECOULEMENT DANS LES PAROIS DE CUVELAGES DE PUITS, ET CUVELAGE DE PUITS**

(54) **METHOD OF REDUCING THE WIDTH OF FLOW OPENINGS IN SIDEWALL OF WELL LINER, AND A WELL LINER**



(57) A method of reducing the width of flow openings in a sidewall of a well liner and a well liner. This method involves the step of applying a wear resistant coating layer to a well liner having a sidewall with a plurality of flow openings. When such a coating is applied, the width of the flow openings is reduced by a selected thickness of the wear resistant coating layer.

ABSTRACT OF THE DISCLOSURE

A method of reducing the width of flow openings in a sidewall of a well liner and a well liner. This method involves the step of applying a wear resistant coating layer to a well liner having a sidewall with a plurality of flow openings. When such a coating is applied, the width of the flow openings is reduced by a selected thickness of the wear resistant coating layer.

TITLE OF THE INVENTION:

Method Of Reducing The Width Of Flow Openings In Sidewall Of Well Liner, And A Well Liner

NAME(S) OF INVENTOR(S):

Jimmy Nelson Potter

FIELD OF THE INVENTION

The present invention relates to a method of reducing the width of slotted or perforated flow openings in a sidewall of a well liner, and a well liner with radial flow openings that has been treated in accordance with the teachings of the method.

BACKGROUND OF THE INVENTION

In order to prevent sand and other particulate matter from plugging off the flow from an oil well, metal pipe is inserted as a liner into the oil well. The liner has slotted or perforated flow openings extending through the sidewall. The flow openings permit the entry of liquids and gases, while serving as a barrier to the entry of solids. The preferred form of flow opening has a key stone shape, which is narrow at the exterior surface of the pipe and then widens toward the interior surface of the pipe. This configuration is used, as it is less prone to plugging. Any sand particles that pass through the narrowing at the exterior surface fall right through the widened portion and are carried away in the flow stream.

The most common form of flow opening is a slot. Slots are cut with a thin cutting blade. With key stone slots, the cutting blade must be inserted twice at an angle to cut underlying material in such a manner that a slot is formed which widens toward the interior surface of the pipe. There has long been a demand for slots of the smallest possible width. The width of the cutting blade used, necessarily limits how small a slot can be cut. It is impractical, if not

impossible, to cut slots under eight thousands of an inch with a cutting blade. The reason for this is that a blade that is less than eight thousands of an inch in thickness, is too fragile to withstand the rigours of the cutting application. This is particularly true for key stone slots, where two cuts are required to create each slot.

There have at least one previous attempt to reduce the width of slotted openings after initial machining. International Patent Application PCT/CA97/00562 published under international publication number WO 98/0635 describes a method of reducing the width of slotted flow openings in a well liner by mechanical manipulation of the exterior surface of the metal pipe.

SUMMARY OF THE INVENTION

The present invention relates to an alternative method of reducing the width of slotted flow openings in metal pipe after initial machining and a well liner with flow openings that has been treated in accordance with the teachings of the method.

According to one aspect of the present invention there is provided a method of reducing the width of flow openings in a sidewall of a metal pipe. This method involves the step of applying a wear resistant coating layer to a metal pipe having a sidewall with a plurality of flow openings. The width of the flow openings is reduced by the wear resistant coating layer.

According to another aspect of the present invention there is provided a well liner that consists of a tubular body having a form defining sidewall. A plurality of flow openings of a selected width extend through the sidewall. A wear resistant coating layer is provided on the tubular body. The width of the flow openings is reduced by the coating layer.

The above described method and the resulting well liner involves a paradigm shift in approach to the problem of flow

opening size. It provides a number of advantages. The flow openings are machined in a size that is easy to work with. Care can be taken to prepare whatever profile is considered to be best suited for the intended application. At the present time key stone slots are the preferred form and configuration of flow opening. Material is then added back onto the liner using one of many coating processes. Beneficial results have been obtained through boronizing.

In initial trials of the method, it worked even better than anticipated. It is possible to closely control the coating processes so as to provide precisely the thickness of coating that is desired. This enables accurate provision of slot widths in the range of one to seven thousands, a range that previously was unheard of. It was discovered that some secondary benefits were also obtained, in that after boronizing the well liner had increased hardness which made it more durable and more resistant to corrosive well fluids.

It will be appreciated that while slots, are currently preferred, perforated flow opening are also in widespread use in the industry and there are other flow opening profiles that could be used. It will also be appreciated that while applying a boron coating through a boronizing process has proven beneficial, there are numerous other coatings, such as polymer coatings, ceramic coatings, and metallic coatings; and numerous other coating processes, such as hard surfacing, electrolysis, plating, painting, and galvanizing that could also be used with beneficial results.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other features of the invention will become more apparent from the following description in which reference is made to the appended drawings, wherein:

FIGURE 1 is a perspective view of a slotted well liner fabricated in accordance with the teachings of the present invention.

FIGURE 2 is an enlarged detailed section view of a slot in the slotted well liner illustrated in **FIGURE 1**, after the slot has been treated in accordance with the teachings of the present method.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

The preferred embodiment, a well liner generally identified by reference numeral 10, will now be described with reference to **FIGURES 1** and **2**.

Well liner 10 is first machined in a conventional manner. Referring to **FIGURE 1**, after initial machining well liner 10 consists of a metallic tubular body 12 having a form defining sidewall 14. A plurality of radial slotted flow openings 16 of a selected width extend through sidewall 14. Well liner 10 is then subjected to a coating treatment to reduce the width of flow openings in accordance with the teachings of the present method. The preferred coating treatment is boronizing.

The method consists of the step of boronizing a wear resistant boron coating layer 18 to metal tubular body 12. Referring to **FIGURE 2**, when this is done, the width of slotted flow openings 16 are reduced by a selected thickness of wear resistant boron coating layer 18.

The preferred process has been described. It will be apparent to one skilled in the art that there are a number of variations that can be made. The flow openings do not have to be slotted, there are other flow openings that could be used and still provide beneficial results. The coating process does not have to be boronizing and the coating does not have to be boron, there are numerous other coating processes and coatings that could be used and still provide beneficial results. It will also be apparent to one skilled in the art that other modifications may be made to the illustrated embodiment without departing from the spirit and scope of the invention as

hereinafter defined in the Claims.

THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:

1. A method of reducing the width of flow openings in a sidewall of a metal pipe; comprising the step of:

applying a coating layer to a metal pipe having a sidewall with a plurality of flow openings, the width of the flow openings being reduced by the coating layer.

2. The method as defined in Claim 1, wherein the flow openings are slots.

3. The method as defined in Claim 1, wherein the flow openings are perforations.

4. The method as defined in Claim 1, wherein the coating has wear resistant properties.

5. The method as defined in Claim 4, wherein the coating is boron.

6. The method as defined in Claim 4, wherein the coating is chromium.

7. A method of reducing the width of flow openings in a sidewall of a metal pipe; comprising the step of:

boronizing a wear resistant boron coating layer to a metal pipe having a sidewall with a plurality of slotted radial flow openings, the width of the slotted flow openings being reduced by a selected thickness of the wear resistant boron coating layer.

8. A well liner, comprising:

a tubular body having a defining sidewall;

a plurality of flow openings of a selected width extending through the sidewall; and

a coating layer on the tubular body, the width of the flow openings being reduced by the coating layer.

9. The well liner as defined in Claim 8, wherein the flow openings are slots.

10. The well liner as defined in Claim 8, wherein the flow openings are perforations.

11. The well liner as defined in Claim 8, wherein the coating has wear resistant properties.

12. The well liner as defined in Claim 11, wherein the coating is boron.

13. The well liner as defined in Claim 11, wherein the coating is chromium.

14. A well liner, comprising:

a metallic tubular body having a form defining sidewall;

a plurality of radial slotted flow openings of a selected width extending through the sidewall; and

a wear resistant boron coating layer on the tubular body, the width of the flow openings being reduced by a selected thickness of the boron coating layer.

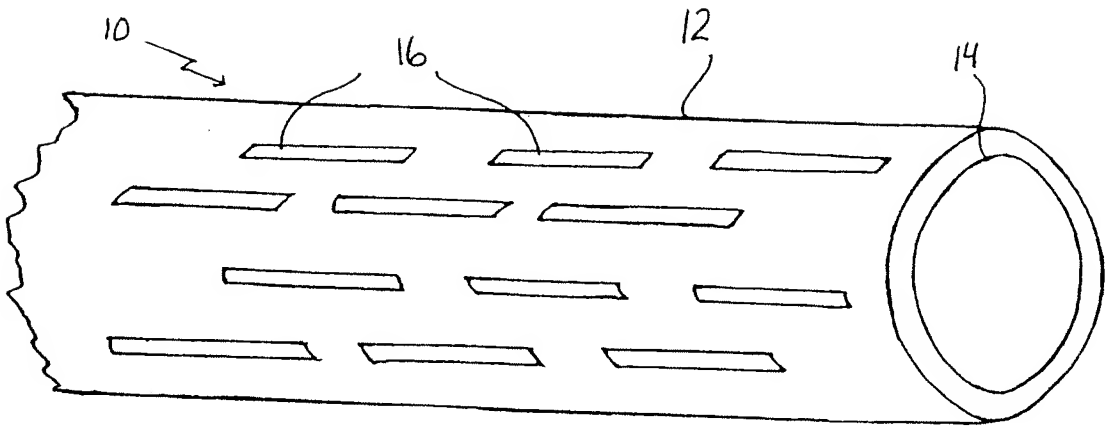


FIGURE 1

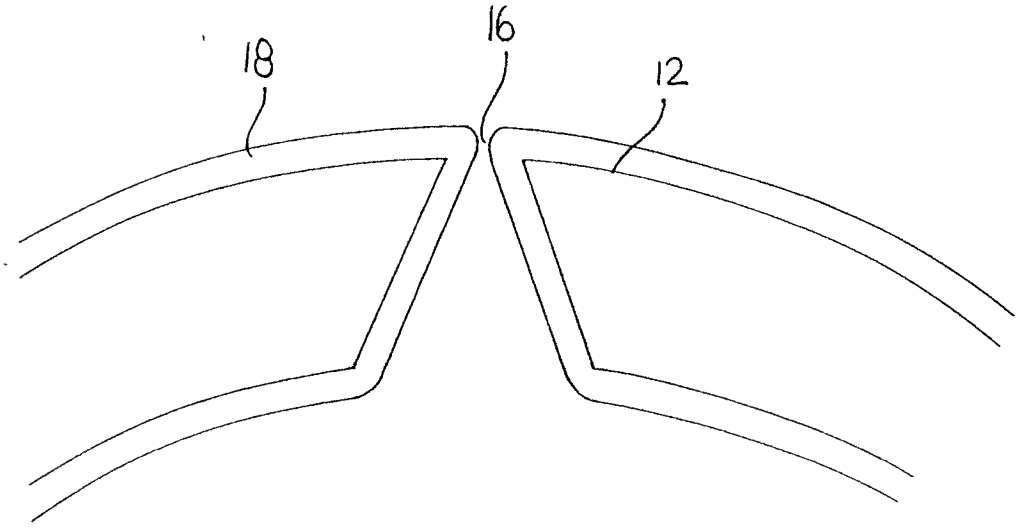


FIGURE 2